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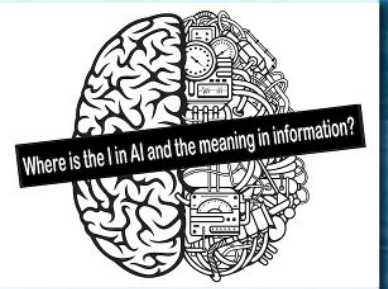

Analysis of the Diversification of Symbolic Systems in the Human Evolution

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Overview

1. Introduction
2. Symbolic system of chimpanzees' lexigrams
3. First symbolic system of earlier hominids (mate contract)
4. Other symbolic systems (language, art, music, myth, math, science)
5. Three roles of symbolic system (communication, knowledge, normativity)
6. Different sources of the emergent constraints of the symbolic systems
7. The idea of a 2nd symbolic hierarchic transition in the human evolution
8. Conclusion

Introduction

The hypothesis at stake:

- In Deacon's theory (*The Symbolic Species*, 1997) the first symbolic systems gave rise to language (unique in the world)
- Did they give rise to other symbolic systems?
- Are we a **symbolic** species or a **languaged** species?

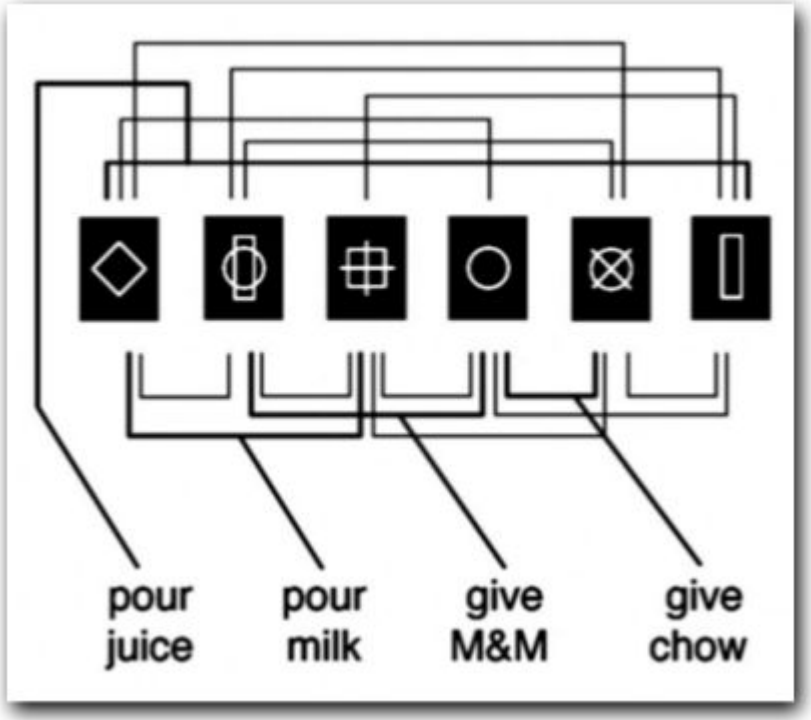
How to check this hypothesis?

- Examine the features of the various symbolic systems
- Identify their similarities and differences; their common roles
- Identify kinds of symbolic systems and their emergent constraints

Simple symbolic system of chimpanzees' lexigrams

- Transition from indices to symbols is demonstrated in a very simple symbolic system, learned by two chimpanzees, Sherman & Austin
- Thousands of trials to discover symbolic reference in small 6-lexigram system (2 foods, 2 drinks, 2 action verbs: 'to give' and 'to pour')

Simple symbolic system of chimpanzee's lexigrams



Six lexigrams

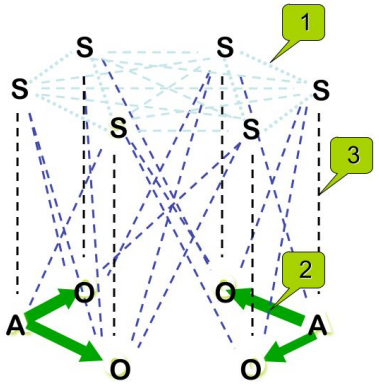
- 2 foods
- 2 drinks
- 2 verbs (give and pour)

The transition involved learning a system of combinatorial exclusion relations between lexigrams (i.e. food is not poured, drink is not given)

Acquiring symbolic reference stage 1: Sorting possible combinatorial associations

Stage 1

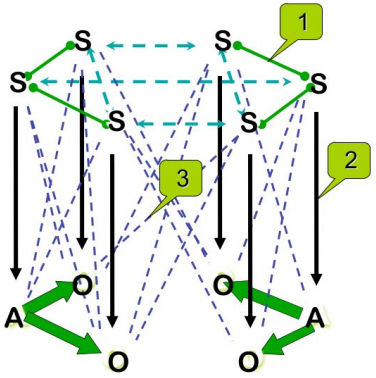
Even for a small set of sign tokens (S), the number of possible sign combinations [1] and their correlations with objects (O) and action- A relations [2] can be immense. Sorting successful from unsuccessful trials taxes working memory but may be aided by training on initially simplified false correlations [3] . . . i.e. reductio ad absurdum



Acquiring symbolic reference stage 2: Discovering indexical associations

Stage 2

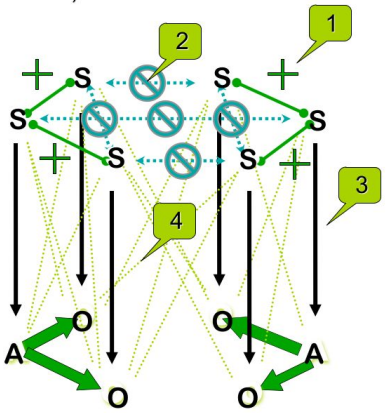
Learning to make token-token (S-S) combinations [1] that correlate with successful indication [2] (and thus acquisition) of an object O via a specific instrumental action A is supported by the memory trace of many past errors. [3]



Acquiring symbolic reference stage 3: Regularizing indexical links (correlations)

Stage 3

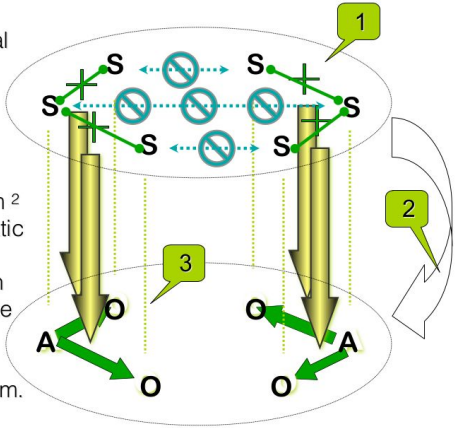
Learning all patterns of allowed token-token combinations [1] and exclusions [2] allows the learner to focus on the indexical correlations between tokens and physical consequences [3] and allows the non-correlations to be progressively ignored. [4]



Acquiring symbolic reference stage 4: Discovering system-system iconism (relational correspondences)

Stage 4

Full system [1] of logical relationships among symbol tokens becomes the focus. This frees mnemonic load and leads to recognition of iconism [2] with physical-pragmatic relationships. This enables symbol token relationships to denote objects [3] mediated indirectly via this system-system iconism.



Conclusions about simple symbolic system

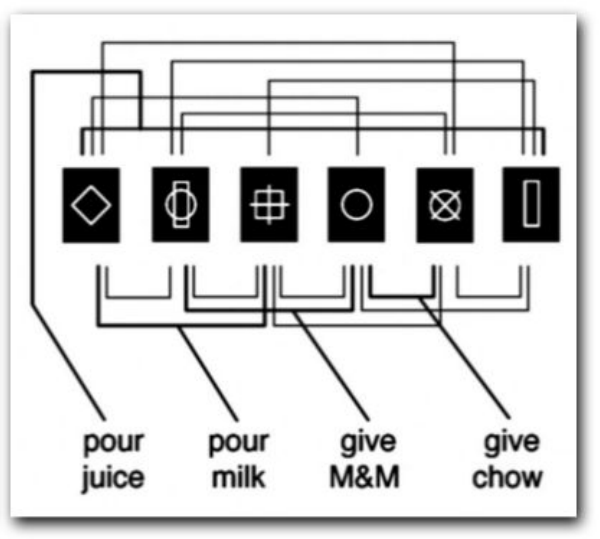
- Iconic and indexical infrastructure is essential for symbolic reference
- What is discovered is a symbolic system of liquid-solid classification
- A symbolic system
  - is not imposed; it emerges from a system of iconic and indexical references that are used (un)successfully to get foods and drinks
- To leap from icon/index to symbol chimps have to drop icon/index, to ignore the icon/index relationships, to perceive what is "behind" them
- Once chimpanzees learned, it became easier to add other lexigrams

Special conditions for 1st symbolic system

1. Unstable social niche:
    - Male hominids hunting together for the whole group
    - Female hominids jointly taking care of children
    - Monogamous couples living together in small social groups
2. Hypothesis of the first symbolic system:
    - 'Mate contract' to inform symbolically who can mate with whom
    - Emerged via repeated rituals with members of a hominid group
    - Simple symbols that marked the "married" couple

Emergence of 1st symbolic system

Six Lexigram Symbols



Liquid / Solid Classification

Simple Symbols of "Mate Contract"

Married / Available Classification

Other possible simple symbolic systems

Kinship identity, Group identity, Hunter identity, and Incest taboo

Group identity

Kinship identity

Hunter identity

Later symbolic systems

1. After 2 millions years the first symbolic systems transformed into: Language, Art, Music, Myth, Religion, Mathematic, Science, others?
2. Key-question:
    - Were the later symbolic systems variations on or distinct from language?
3. If they were distinct:
    - What are the main differences between them?
    - Are there common features to all symbolic systems?
    - What are the main roles of symbolic systems?

What is a symbolic system ?

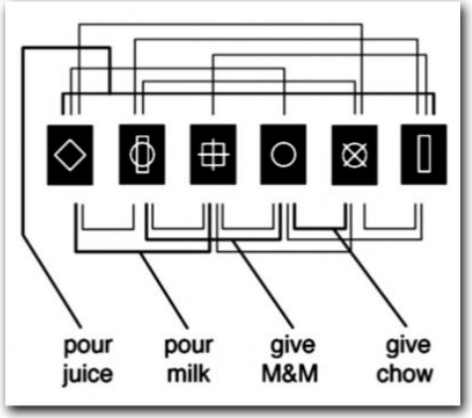
A definition:

"A structured and systematic network of symbolic references, reciprocally referenced, that emerges from a previous process of experiences of iconic and indexical references"

Notes:

- Previous process may be training, ritualistic ceremonies, learning
- Symbolic system emerges by repeated rituals, training, learning
- In general, symbolic systems don't emerge consciously
- Acquiring and using a symbol system must both be explained

Simple Symbolic Systems



Six lexigrams

Mate contract

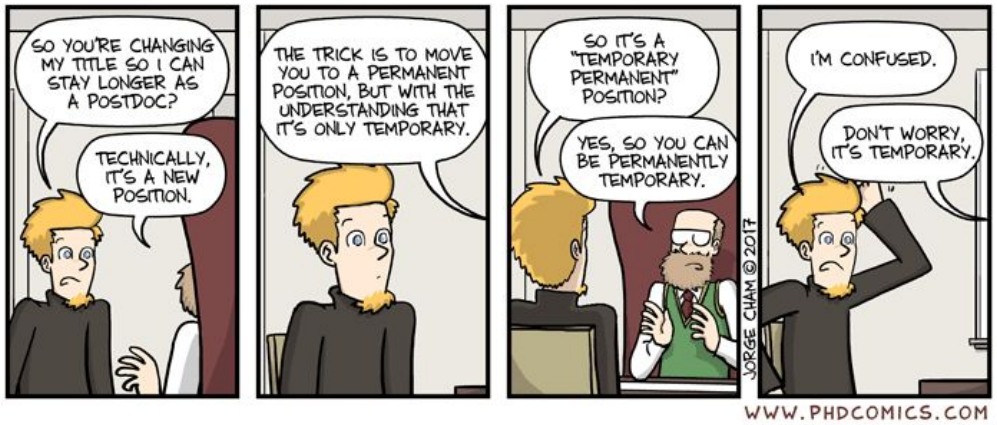
Group identity

- Symbolic systems seem to include at least three roles:
  - Communication
  - Knowledge
  - Normativity
- Symbols of "mate contract" communicate who is "married" with whom, inform a knowledge of that situation, and is normative → regulates who can mate whom (convention)
- Is that true for all symbolic systems?

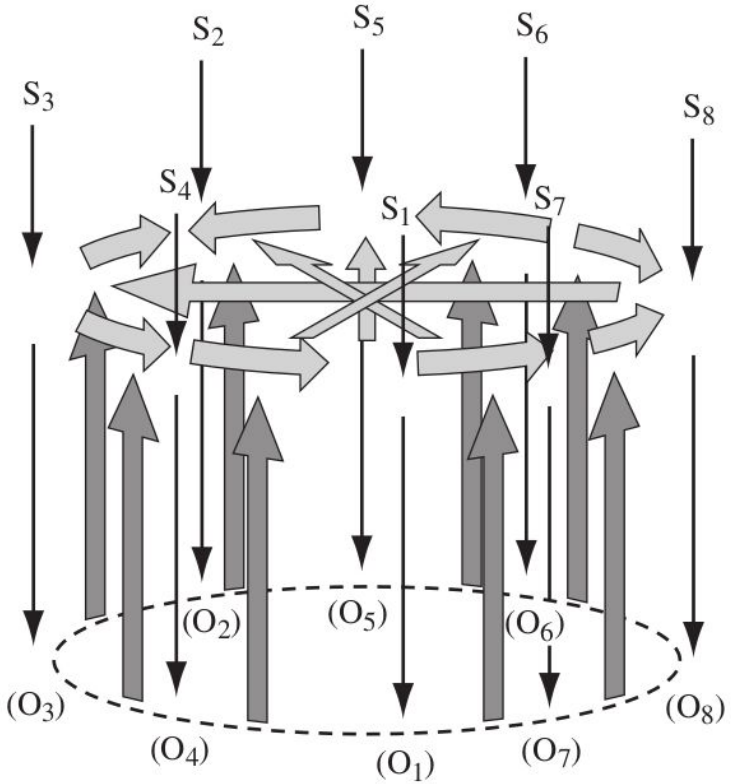
Incest taboo

Evolved Symbolic Systems

Language



- Most sophisticated symbolic system
- Specialized to symbolic communication
- Composed of symbolic words that form sentences, capable to represent anything
- Complex grammar and syntactic rules
- Vast network of symbol tokens (words)
- Evolved to be easily learned by children



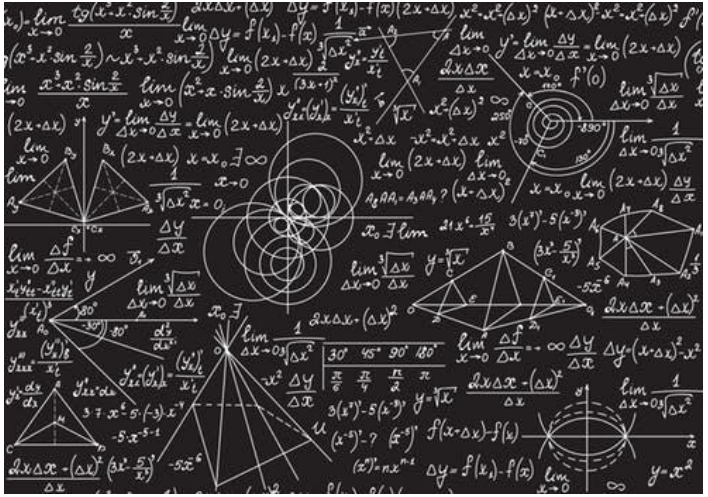
Schematic depiction of the logic of symbolic relationships in terms of their component indexical infrastructure

Art

Music

- Aesthetic and musical expressions are diverse and **communicate feelings**
- Forms of expression:
  - Visual
  - Corporal
  - Musical
- Generally, they are not spoken, but in singing, theater and poems they are
- Express an **internal and emotional knowledge** about the world and people

Mathematics

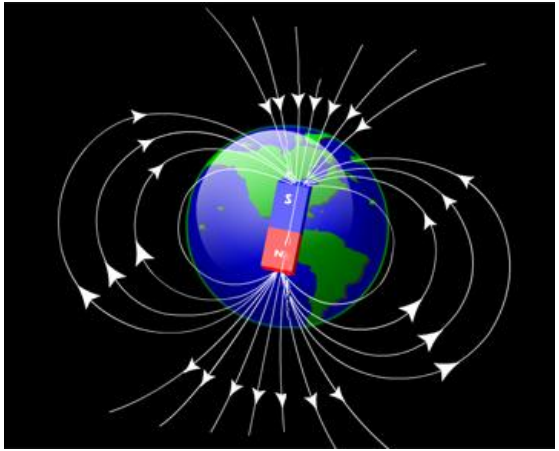


Sciences

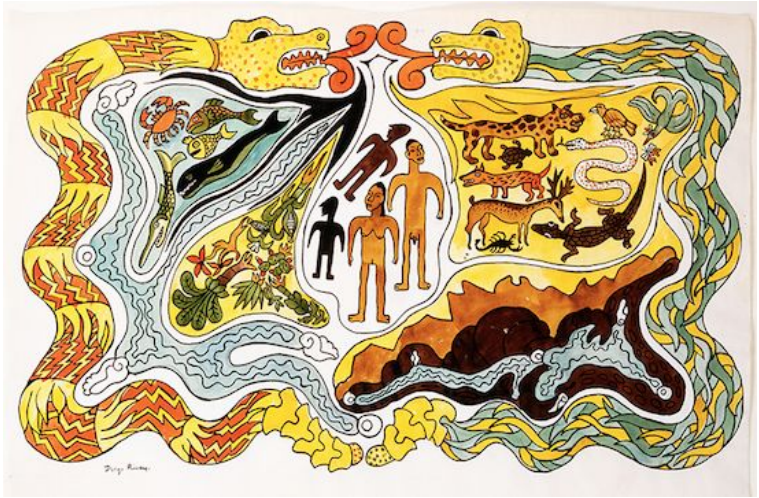
F = ma

THE NET FORCE EQUALS
THE MASS OF THE OBJECT
MULTIPLIED BY
THE AMOUNT
OF ACCELERATION

- Mathematics and scientific theories **communicate knowledge** about the world and people
- They may be **"spoken"**, but...
  are their symbols, concepts and theories linguistic?
- Knowledge about the world is inherently **normative**:
  Expressing best (most accurately) the way things work; defines the ways things can be manipulated and transformed in functional (useful) ways.



Myth



Religion

- Myths:
  - tell **the story** of a people, their origin, identity, values and meanings
  - **communicate** the whole ideas present and valid to a society (culture)
  - express the current **knowledge** of a given society
  - set up the **normativity** of a society (morality, what's right and wrong)
  - **are always spoken orally**
  - also express, like art, an emotional knowledge about world and people
- Religion appears later with first civilizations through written records (writing)

Roles and aspects of symbolic systems

Three roles:

1) Communication
2) Knowledge → about nature, social relationships and individuals
3) Normativity → what should and shouldn't be done, and how

Some aspects:

- Constraints on human activities (what they can do, and even think)
- Power over nature, and over of social group (i.e. to manipulate them)
- Subjective internal knowledge related to believe and individual identity
- Desire, guilt and self-repression (i.e. neurosis)

Criteria to distinguish symbolic systems

- Tentative criteria:
  - Distinct type of symbol tokens (i.e. word, song notes, number)
  - Distinct vocabulary with its own systematic (symbolic) logic
  - Specialized telos (i.e. communication or normativization)
  - Distinct knowledge/normativity of a specific human activity
- Language, art, music, math seem to fulfill these criteria for distinction
- Do other symbolic systems fulfill any of these criteria?
- Hypothesis: as emergent symbolic systems, they may emerge by distinct sources of emergent constraints (with distinct telos)

Supposed sources of emergent constraints

Language:

- Its symbolic system emerges to avoid ambiguities

Mate contract, group identity, incest taboo, myth, religion, politics:

- To avoid social conflicts (emergent moral constraints?)

Mathematics:

- To avoid misinterpreting quantity

Intuitive knowledge, science:

- To avoid misinterpreting nature (to use and manipulate its resources)

Music, art:

- To avoid "dissonance" of sounds, and "ugliness" of artistic expressions

Methodological guidelines

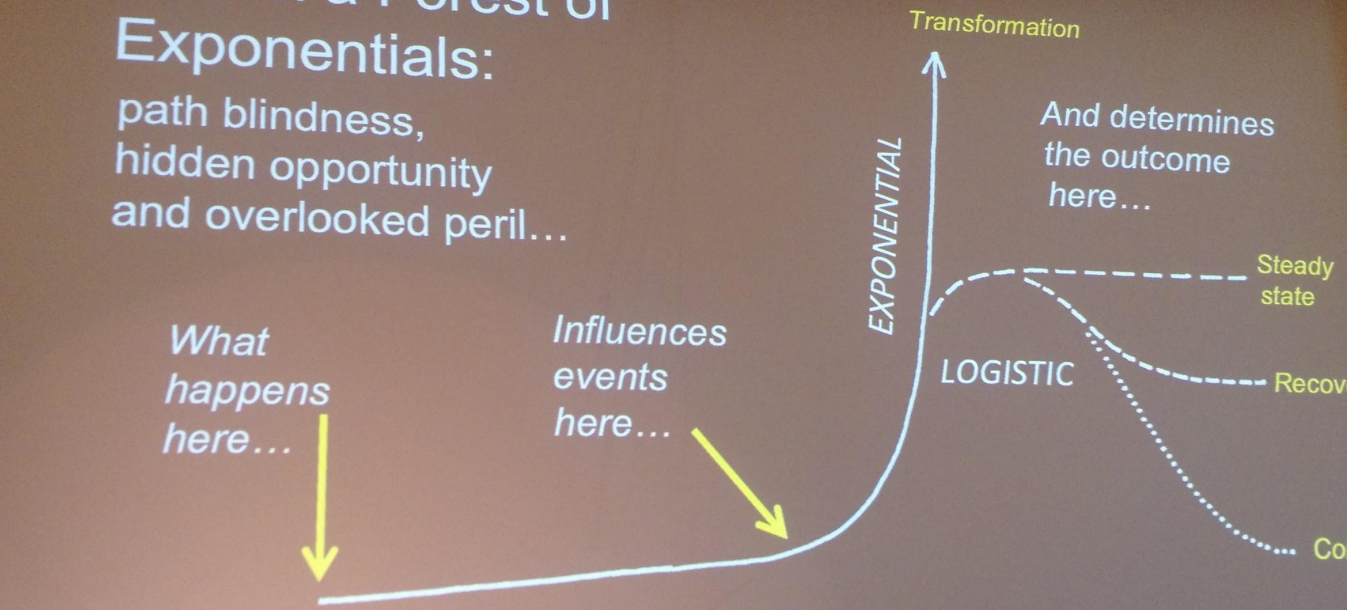
- According to Deacon's biosemiotic information theory, research should:
  - Deepen the study of nested semiotic process of other symbolic systems and their relationships to language
  - Understand how new synergies arise through a process of duplication, relaxed selection and degradation in the symbolic level
  - Examine the working of the emergent constraints to grasp possible synergies between two or more symbolic systems
- From other theoretical alternatives:
  - Tomlinson: insights on "cultural archives" passed on by language

Idea of 2nd symbolic hierarchic transition

- Duplication of forms of getting food
- Emergence of first sedentary civilizations (Sumerians, Babylonians, Chinese)
- Relaxed selection effects: longer time to several other human activities
- Degradation of old social activities like hunting-gathering → social addiction
- Degradation of old symbolic systems (Myths) gives rise to religious ones
- Duplication of language: the invention of written and counting records
- Relaxed selection effects: longer time to think theoretically about knowledge
- 1st manifestation of a new synergistic level with philosophy and democracy
- Further duplications, relaxed selection and degradation of knowledge, giving rise later to new synergies as science and technology;

Lost in a Forest of Exponentials:

path blindness,
hidden opportunity
and overlooked peril…



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Conclusion

- The questions about the evolution from the first symbolic systems:
  1) Did they give rise to other symbolic systems?
  2) Are we a symbolic species or a languaged species?
- Music, art and math are indeed distinct symbolic systems
- Too early for a final conclusion about the other symbolic systems
- Need to deepen the investigations

Thank you for the attention